CLAIMS

What is claimed is:

1. A method for producing an abrasion resistant coating composed of a ceramic/metal material system or a ceramic/ceramic material system, the method comprising the steps of:

blending micron-scale particles of a hard phase material with nano-scale particles of a binder phase material to form a uniform powder mixture;

aggregating of the powder mixture to bond the nano-scale particles to the micron-scale particles thereby forming a feedstock powder comprised of aggregated particles; and

thermal spraying the feedstock powder of particle aggregates onto a substrate thereby forming the abrasion resistant coating thereon, the coating composed of the micron-scale particles of the hard phase material fused together with the binder phase material.

2. The method according to claim 1, wherein in the blending step the micron-scale particles of the hard phase material are arranged in particle aggregates.

3. The method according to claim 2, wherein the particles are different sizes.

4. The method according to claim 3, wherein the particles are different in composition.

5. The method according to claim 2, wherein the particles are different in composition.

6. The method according to claim 1, further comprising the step of agglomerating the powder mixture formed in the blending step prior to performing the aggregating step.

7. The method according to claim 6, wherein the agglomerating step is performed by spray drying and the particle aggregates are each about 5 to 50 microns in diameter.

8. The method according to claim 1, wherein the hard phase material includes one of a ceramic or a ceramic/metal composite.

9. The method according to claim 1, wherein the binder phase material includes one of a metal, ceramic and ceramic/metal composite.

10. The method according to claim 1, wherein the micron-scale particles of the hard phase material comprises between 50 and 90 volume percent of the blended powder mixture.

11. The method according to claim 1, wherein the micron-scale particles of the hard phase material comprises 70 volume percent of the blended powder mixture.

12. The method according to claim 1, wherein the aggregating step is performed by heat treating.

13. The method according to claim 1, wherein during the thermal spraying step the nano-scale particles of the binder phase material are selectively melted, the melted particles filling pore spaces between heated and softened ones of the micron-scale particles, thereby effectively binding the micron-scale particles together and densifying the coating.

14. The method according to claim 13, wherein during the thermal spraying step the melted particles experience a cooling rate which generates one of an amorphous nanocrystalline or microcrystalline binder phase.

15. The method according to claim 1, wherein the ceramic/metal material system is selected from the group consisting of WC/Co, Cr_3C_2/NiCr, TiC/Fe, metal boride/metal, and metal nitride/metal and the ceramic/ceramic material system is selected from the group consisting of Al_2O_3, YSZ, Al_2O_3/TiO_2, ZrO_2/MgO, and Cr_2O_3/SiO_2.

16. A method of making a feedstock powder for use in producing thermal spray abrasion resistant coatings composed of a ceramic/metal material system or a ceramic/ceramic material system, the method comprising the steps of:

blending micron-scale particles of a hard phase material with a nano-scale particles of a binder phase material to form a uniform powder mixture; and

aggregating of the powder mixture to bond the nano-scale particles to the micron-scale particles thereby forming particle aggregates which from the feedstock powder.

17. The method according to claim 16, wherein in the blending step the micron-scale particles of the hard phase material are arranged in particle aggregates.

18. The method according to claim 17, wherein the particles are different sizes.

19. The method according to claim 18, wherein the particles are different in composition.

20. The method according to claim 17, wherein the particles are different in composition.

21. The method according to claim 1, further comprising the step of agglomerating the powder mixture formed in the blending step prior performing the aggregating step.

22. The method according to claim 21, wherein the agglomerating step is performed by spray drying and the particle aggregates are each about 5 to 50 microns in diameter.

23. The method according to claim 1, wherein the hard phase material includes one of a ceramic or a ceramic/metal composite.

24. The method according to claim 1, wherein the binder phase material includes one of a metal, ceramic and ceramic/metal composite.

25. The method according to claim 1, wherein the micron-scale particles of the hard phase material comprises between 50 and 90 volume percent of the blended powder mixture.

26. The method according to claim 1, wherein the micron-scale particles of the hard phase material comprises 70 volume percent of the blended powder mixture.

27. The method according to claim 1, wherein the aggregating step is performed by heat treating.

28. The method according to claim 1, wherein the ceramic/metal material system is selected from the group consisting of WC/Co, Cr_3C_2/NiCr, TiC/Fe, metal boride/metal, and metal nitride/metal and the ceramic/ceramic material system is selected from the group consisting of Al_2O_3, YSZ, Al_2O_3/TiO_2, ZrO_2/MgO, and Cr_2O_3/SiO_2.

29. An abrasion resistant coating comprising:

a binder phase material formed from nano-scale particles; and

micron-scale particles of a hard phase material fused together with the binder phase material.

30. The coating according to claim 29, wherein the binder and hard phase materials are composed of a ceramic/metal material system.

31. The coating according to claim 30, wherein the ceramic/metal material system is selected from the group consisting of WC/Co, Cr_3C_2/NiCr, TiC/Fe, metal boride/metal, and metal nitride/metal.

32. The coating according to claim 29, wherein the binder and hard phase materials are composed of a ceramic/ceramic material system.

33. The coating according to claim 32, wherein the ceramic/ceramic material system is selected from the group consisting of Al_2O_3, YSZ, Al_2O_3/TiO_2, ZrO_2/MgO, and Cr_2O_3/SiO_2.